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Differences in folic acid use, prenatal care, smoking, and drinking in early pregnancy by occupation

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Abstract

Objective—To describe differences in four high risk periconceptional behaviors (lack of folic acid supplementation, lack of early prenatal care, smoking, and drinking) by maternal occupation.

Methods—Analyses were conducted among women in the National Birth Defects Prevention Study who delivered liveborn infants without birth defects. Periconceptional occupational data were collected using a computer-assisted telephone interview and occupational coding was performed using the 2000 Standard Occupational Classification System. Logistic regression analyses were conducted to determine whether prevalence of behaviors differed between occupational groups.

Results—Subjects included 5153 women employed during early pregnancy from 1997 to 2007. Compared to women in management, business, science, and arts occupations, women in other occupations (e.g., service occupations) were significantly more likely to engage in all four high risk behaviors. Specifically, women in food preparation/serving-related occupations were significantly more likely to engage in all four behaviors compared to women in all other occupational groups (odds ratios: 1.8–3.0), while women in education/training/library occupations were significantly less likely to do so (odds ratios: 0.2–0.5).

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Conflict of interest statement

The authors declare that there is no conflict of interest.

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Conclusion—We identified several occupational groups with an increased prevalence of high-risk maternal behaviors during pregnancy. Our findings could aid in developing interventions targeted towards women in these occupational groups.

Keywords

Folic acid; Prenatal care; Smoking; Alcohol drinking; Occupations; Pregnancy; Epidemiology

Introduction

Some of the most common, modifiable, and relatively strong risk factors for adverse pregnancy outcomes are lack of periconceptional folic acid supplementation, lack of early prenatal care, smoking, and alcohol use (Banakar et al., 2009; Ip et al., 2010; Salmasi et al., 2010; Vintzileos et al., 2002; Werler et al., 1999). Despite medical recommendations and educational programs, a substantial proportion of pregnant women engage in each of these behaviors (Bailey and Sokol, 2008; Centers for Disease Control and Prevention, 1992; U.S. Preventive Services Task Force, 2009; Vintzileos et al., 2002). Hence, additional efforts to reduce these behaviors are warranted.

While it is known that several of these behaviors vary by occupation in the general population (Cano-Serral et al., 2006; Milham and Davis, 1991; Salvador et al., 2007) they have not been assessed among pregnant workers. The identification of maternal occupational groups that are associated with high rates of high-risk behaviors could provide target groups for focused educational campaigns. Such targeted strategies would be warranted even if occupation is indirectly related to these behaviors through the characteristics of women (e.g. educational level, age) who enter particular occupations, since occupation may be easier to target than would the underlying maternal characteristic.

The direct and indirect costs of maternal and child healthcare are great, and to contain rising employee health insurance costs, considerable effort is being put forward to prioritize, develop, and implement workplace health promotion activities (Campbell, 2007; Chapman, 2005). We conducted these analyses to identify differences in maternal folic acid supplementation, early prenatal care, smoking, and mild to moderate drinking during early pregnancy by maternal occupational group in a population-based study. Identifying occupational groups with high rates of high-risk behaviors could be useful in deciding where an investment in health promotion activities (e.g., workplace education or interventions) aimed at reducing high risk behaviors among women of reproductive age could improve reproductive outcomes and reduce healthcare costs.

Materials and methods

Study sample

We used data from the mothers of infants with due dates between October 1, 1997 and December 31, 2007 in the National Birth Defects Prevention Study (NBDPS), a large population-based case–control study. Only mothers of non-malformed control infants were included in these analyses, as they are more likely than mothers of cases to represent the

distribution of behaviors in the general population and including case mothers would select for women that were more likely to participate in these behaviors. The details of the methods used for NBDPS subject recruitment and data collection are published elsewhere (Yoon et al., 2001). Briefly, control infants were randomly selected among liveborn infants without birth defects from birth certificates or birth hospitals in ten birth defects surveillance areas (Arkansas, California, Georgia, Iowa, Massachusetts, New Jersey, New York, North Carolina, Texas, and Utah); study methods were approved by the Institutional Review Boards from each study site.

Mothers participated in a computer-assisted telephone interview conducted in English or Spanish by trained interviewers within two years of delivery. During this interview, mothers provided information about potential exposures before and during pregnancy, pregnancy and family histories, lifestyle/behavioral factors, occupation, and maternal health conditions.

Outcomes

Four common, modifiable maternal behaviors reported during the interview were considered: folic acid supplementation (any use of folic acid, multivitamin, or prenatal supplement versus none) from one month before pregnancy (B1) through the first month of pregnancy (P1), any prenatal care (yes versus no) from B1 through the third month of pregnancy (P3), any smoking (yes versus no) from B1–P3, and alcohol consumption (moderate to heavy drinking versus light or no drinking) from B1–P3. Moderate to heavy drinking was defined as an average of more than one drink per day in any month from B1–P3. We also considered alternative definitions for these outcomes, including daily use of folic acid supplements (yes versus no), heavy smoking (more than a half pack of cigarettes per day average in any month during B1–P3), and binge drinking (more than five drinks in any single day during B1–P3).

Exposures

Data on maternal jobs and dates/hours worked during the three months before through the end of pregnancy were collected during the computer-assisted interview. All occupations were classified into categories from the 2000 Standard Occupational Classification (SOC) System (United States Department of Labor Bureau of Labor Statistics, 2001). The SOC codes indicate hierarchical levels of organization, including 821 detailed occupations that fall under 23 major occupational groups (United States Department of Labor Bureau of Labor Statistics, 2001).

To make broad comparisons between occupations, the 23 major occupational groups were combined into two aggregate groups based on the six high-level groupings in the 2010 SOC system (United States Department of Labor Bureau of Labor Statistics, 2010). Aggregate group one, “management, business, science, and arts occupations,” represented approximately half of the occupations in the dataset, and was defined by the 2010 SOC “high-level aggregation” group one (United States Department of Labor Bureau of Labor Statistics, 2001). Aggregate group two consisted of the remaining “high-level aggregation” groups, the majority of which were service, sales/office, and production/transportation/material moving occupations.

The present analyses considered jobs worked during B1 through P3. For women with multiple jobs, only the primary occupation during this period was considered (i.e., the job with most weekly hours worked). Women who were unemployed during the entire B1 through P3 period, or who could not be assigned to an occupation during this period due to missing or incomplete occupational data, were excluded. To assess the possibility of bias resulting from differentially missing data for employment start or end date, we also conducted subanalyses in which we assumed any job with missing start or end dates occurred between B1 and P3.

Statistical analyses

Aggregate occupational groups—For each behavior, the crude odds ratio (OR) and 95% confidence interval (CI) in aggregate group two was compared to aggregate group one using unconditional logistic regression. Exploratory analyses were also conducted by repeating logistic regression analyses, adjusting for some characteristics that might influence a woman's occupation, including: maternal race/ethnicity (white, black, Hispanic, other), education (<high school, high school, >high school), age (<18, 18–19, 20–24, 25–29, 30–34, 35–39, 40–44, 45–49, >49 years at delivery), and total annual household income (<$10,000, $10,000–$50,000, >$50,000).

Major occupational groups—Analyses were also conducted among the 23 major occupational groups. For major occupational groups with at least 25 women, we determined the prevalence of the four maternal behaviors. For each behavior, the crude odds ratio (OR) and 95% confidence interval (CI) were estimated for each major occupational group, compared to all other occupational groups, using unconditional logistic regression.

For major occupational groups that were significantly associated with all four maternal behaviors, analyses were repeated within more detailed occupational sub-categories, and exploratory logistic regression analyses were repeated, adjusting for maternal race/ethnicity, maternal age, maternal education, and total annual household income.

Results

Among 8494 interviewed NBDPS control mothers, 5153 women employed between B1 and P3 were included in our analyses (Table 1). The majority of these women (87.7%) were employed in only one job during this period. The most common major occupational groups were office/administrative support (21.6%); sales and related (11.4%); education/training/library (9.4%); healthcare practitioners/technical (8.4%); management (7.7%); and food preparation/serving-related (7.6%) occupations. Three occupational groups with less than 25 women each (construction/extraction, N = 16; installation/maintenance/repair, N = 4; and military specific occupations, N = 4) were excluded from subsequent analyses.

Aggregate occupational groups

Compared to women in aggregate group one, the odds of all four high-risk behaviors were significantly higher among women in aggregate group two (lack of any folic acid use OR: 2.89; 95% CI: 2.56–3.25, lack of prenatal care OR: 2.39; 95% CI: 1.92–2.97, smoking OR:

2.84; 95% CI: 2.41–3.35, and moderate to heavy drinking OR: 1.40; 95% CI: 1.05–1.89) (Table 2). After adjusting for total household income, maternal age, maternal race/ethnicity, and maternal education, significant or borderline significant associations remained between aggregate group two occupations compared to aggregate group one and lack of folic acid use (adjusted OR: 1.46; 95% CI: 1.25–1.69), smoking (adjusted OR: 2.05; 95% CI: 1.69–2.50), and moderate to heavy drinking (adjusted OR: 1.39; 95% CI: 0.98–1.97).

Major occupational groups

To better understand the differences observed between the two aggregate occupational groups, we evaluated the 20 eligible major occupational groups represented in the two aggregate groups. Frequencies of each of the four high-risk behaviors were tabulated by occupational group (Table 1) and crude associations between each occupational group and behavior were assessed (Table 2). In general, the analyses of major occupational groups were consistent with the analyses of aggregate occupational groups, in that women in major occupational groups falling within aggregate group two were more likely to engage in high risk behaviors and those in major occupational groups falling within aggregate group one were less likely, compared to all other occupational groups.

The major occupational groups in which women were the least likely to use folic acid, least likely to have prenatal care, most likely to smoke, and most likely to engage in moderate to heavy drinking were farming/fishing/forestry (OR: 4.62; 95% CI: 2.50–8.55), building and grounds cleaning/maintenance (OR: 2.69; 95% CI: 1.75–4.13), food preparation/serving-related (OR: 2.98; 95% CI: 2.40–3.70), and food preparation/serving-related (OR: 2.72; 95% CI: 1.88–3.93) occupations, respectively (Table 2). Notably, across all the occupations, only women in food preparation/serving-related jobs were significantly more likely to engage in each of the four high-risk behaviors. In contrast, only women in education/training/library jobs had significantly lower odds of engaging in all of the four behaviors (Table 2).

After adjusting for total household income, maternal age, maternal race/ethnicity, and maternal education, significant associations remained between food preparation/serving-related occupations and lack of folic acid use (adjusted OR: 1.36; 95% CI: 1.07–1.74), smoking (adjusted OR: 2.07; 95% CI: 1.62–2.65), and moderate to heavy drinking (adjusted OR: 2.57; 95% CI: 1.71–3.87), but not lack of prenatal care. Similarly, significant or borderline significant protective associations between education/training/library occupations and all four behaviors remained (lack of any folic acid use adjusted OR: 0.78; 95% CI: 0.62–0.97, lack of prenatal care adjusted OR: 0.64; 95% CI: 0.41–1.02, smoking adjusted OR: 0.30; 95% CI: 0.20–0.45, and moderate to heavy drinking adjusted OR: 0.44; 95% CI: 0.22–0.87).

Analyses were repeated within specific occupational subgroups of each of these two major occupational groups, using all other major occupational groups as the reference group (Supplemental Table 1). In general, results among the occupational subgroups were similar to those among the two major occupational groups, although the subgroup of “other food preparation/serving-related workers” was more strongly associated with lack of prenatal care (OR: 4.22; 95% CI: 2.12–8.41) than the other food preparation/serving-related subgroups.

The results of analyses using the alternative definitions of folic acid use, smoking, and drinking were similar to the main results, as were the results of analyses in which we assumed that occupations missing beginning or ending dates occurred during B1 through P3 (data not shown).

Discussion

Using data from a large, population-based study, we identified several occupational groups in which women were less likely to use folic acid or have prenatal care, and were more likely to engage in smoking or moderate to heavy drinking during early pregnancy. Occupations in which women were more likely to engage in one or more of the four high-risk behaviors included: healthcare support, protective service, food preparation/serving-related, building and grounds cleaning/maintenance, sales and related, farming/fishing/forestry, production, and transportation/material moving occupations. Because these behaviors are modifiable and are known risk factors for adverse pregnancy outcomes, women in these occupations may benefit from targeted health promotion interventions.

Few studies have evaluated the prevalence of any of these four high-risk behaviors during pregnancy in specific occupational groups. Our findings seem consistent with a previous study that found that pregnant women in Spain who performed manual labor were significantly more likely to smoke, not use folic acid, and not undergo first trimester prenatal care compared to those with non-manual labor occupations (Cano-Serral et al., 2006; Salvador et al., 2007). Our results also seem consistent with a study that used birth certificate records to evaluate maternal occupation and smoking any time during pregnancy, and found that rates of smoking during pregnancy were elevated in maternal occupations where alcohol was served, “traditionally male occupations”, and occupations with exposure to toxic or carcinogenic substances (Milham and Davis, 1991).

It is likely that the associations observed in the present study reflect differences in the underlying characteristics between women in different occupations. However, it is possible that occupation itself may have an independent effect on certain high-risk behaviors. For example, previous studies have described direct effects of job on health behaviors, both during and outside of work (e.g., through work culture and normalization of behaviors, access to information or support, health care benefits, work-related stress) (Eakin, 1997; Green and Johnson, 1990; Johansson et al., 1991; Karasek et al., 1987; Landsbergis et al., 1998; Mullen, 1992). Further, in our analyses, many of the associations with high-level aggregate and major occupational groups remained after adjustment for several demographic factors. Thus, it seems likely that maternal high-risk behaviors are influenced by both underlying characteristics (e.g., race/ethnicity) and occupation-related (e.g., work culture) factors. While additional research will be required to more fully understand the relationship between maternal occupation and behavior, such an understanding is not required for the development of intervention strategies targeted to high-risk occupations.

A major strength of this study was our use of a large population-based sample and standardized occupational group definitions increased this study's external validity. However, because analyses were conducted among women who ultimately delivered

liveborn non-malformed offspring, we cannot definitively know if results are generalizable to women who ultimately have adverse pregnancy outcomes. Further, control mothers who participate in the NBDPS have been shown to be generally representative of the populations from which they were drawn, although minor differences may be present for maternal race/ethnicity, education, and onset of prenatal care (Cogswell et al., 2009). Results should be interpreted in light of the fact that many comparisons were made, however the apparent trends (e.g., consistency across behaviors and between results from high-level aggregation categories and major occupation categories) suggest that the majority of results were not due to chance alone. Although results from analyses repeated using different outcome and exposure definitions were similar to the main results, we did not consider exposure definitions that accounted for number of hours worked or that differentiated between women with only one job versus more than one. We cannot rule out the possibility of women in certain occupations recalling exposures more or less accurately. Some occupational groups had small numbers and we likely had limited statistical power to detect significant associations in these groups.

In summary, we identified several occupational groups in which women were more likely to smoke, consume alcohol, not use folic acid, or not have prenatal care during early pregnancy. Discovery of these associations identifies high-risk occupational groups that could be targeted for health promotion activities (e.g., workplace interventions). Better understanding of characteristics that motivate high-risk behaviors could further inform workplace health promotion activities. The development of successful workplace health promotion strategies that reduce the prevalence of high-risk behaviors could both improve maternal and child health and reduce healthcare costs.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

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Table 1

Frequencies of behaviors during B1–P3[a] by occupation among pregnant women with jobs during B1–P3, National Birth Defects Prevention Study, 1997–2007[b].

Occupational group	Total employed	Lack of any folic acid use[c]	Lack of prenatal care	Smoking	Moderate to heavy drinking[d]
	N (%)S	N (%)	N (%)	N (%)	N (%)
Management, business, science, and arts occupations[e]					
Management	397 (7.7)	124 (31.2)	20 (5.1)	50 (12.6)	20 (5.0)
Business and financial operations	227 (4.4)	63 (27.8)	13 (5.9)	29 (12.8)	8 (3.5)
Computer and mathematical	85 (1.7)	21 (24.7)	5 (5.9)	6 (7.1)	2 (2.4)
Architecture and engineering	25 (0.5)	4 (16.0)	2 (8.0)	2 (8.0)	2 (8.0)
Life, physical, and social science	75 (1.5)	17 (22.7)	8 (10.7)	6 (8.0)	2 (2.7)
Community and social services	114 (2.2)	35 (30.7)	3 (2.7)	15 (13.2)	2 (1.8)
Legal	64 (1.3)	18 (28.1)	5 (7.8)	8 (12.5)	2 (3.1)
Education, training, and library	484 (9.4)	148 (30.6)	24 (5.1)	27 (5.6)	9 (1.9)
Arts, design, entertainment, sports, and media	83 (1.6)	26 (31.3)	9 (11.0)	14 (16.9)	2 (2.4)
Healthcare practitioners and technical	431 (8.4)	126 (29.2)	23 (5.4)	53 (12.3)	18 (4.2)
Subtotal	1985 (38.7)	582 (29.3)	112 (5.7)	210 (10.6)	67 (3.4)
Other occupations[e,f]					
Healthcare support	240 (4.7)	122 (50.8)	23 (10.1)	64 (26.7)	5 (2.1)
Protective service	40 (0.8)	18 (45.0)	8 (20.0)	10 (25.0)	2 (5.0)
Food preparation and serving-related	390 (7.6)	250 (64.1)	61 (16.1)	153 (39.4)	37 (9.5)
Building and grounds cleaning and maintenance	134 (2.6)	95 (70.9)	28 (22.4)	32 (23.9)	12 (9.0)
Personal care and service	257 (5.0)	116 (45.1)	27 (10.8)	50 (19.5)	12 (4.7)
Sales and related	587 (11.4)	323 (55.0)	69 (12.2)	159 (27.1)	24 (4.1)
Office and administrative support	1114 (21.7)	528 (47.4)	101 (9.3)	235 (21.1)	45 (4.0)
Farming, fishing, and forestry	61 (1.2)	48 (78.7)	10 (18.5)	5 (8.2)	1 (1.6)
Production	212 (4.1)	142 (67.0)	38 (18.8)	55 (25.9)	6 (2.8)
Transportation and material moving	109 (2.1)	71 (65.1)	20 (18.5)	28 (25.7)	3 (2.8)
Subtotal	3144 (61.3)	1431 (45.5)	385 (12.7)	791 (25.2)	147 (4.7)
Total	5129 (100.0)	2295 (44.8)	497 (10.0)	1001 (19.5)	214 (4.2)

[a] One month before pregnancy through the third month of pregnancy.

[b] Frequencies do not include missing data.

[c] During B1–P1 (one month before pregnancy through the first month of pregnancy).

[d] >1 drink per day average in any month.

[e] High-level aggregation groups.

[f] Does not include subjects in occupations with less than 25 women (i.e., construction/extraction, N = 16; installation/maintenance/repair, N = 4; and military specific occupations, N = 4).

Table 2

Unadjusted odds ratios and 95% confidence intervals for the association between occupational groups and behaviors during B1–P3[a], National Birth Defects Prevention Study, 1997–2007.

Occupational group	OR (95% CI)			
	Lack of any folic acid use[b]	Lack of prenatal care	Smoking	Moderate to heavy drinking[c]
High-level aggregation group				
Management, business, science, and arts (group one)	1.00	1.00	1.00	1.00
Other occupations[d] (group two)	**2.89 (2.56–3.25)**	**2.39 (1.92–2.97)**	**2.84 (2.41–3.35)**	**1.40 (1.05–1.89)**
Major groups[e]				
Group one				
Management	**0.53 (0.43–0.67)**	**0.46 (0.29–0.73)**	**0.57 (0.42–0.77)**	1.25 (0.78–2.00)
Business and financial operations	**0.46 (0.34–0.62)**	**0.55 (0.31–0.96)**	**0.59 (0.40–0.88)**	0.84 (0.41–1.72)
Computer and mathematical	**0.40 (0.24–0.65)**	0.56 (0.23–1.38)	**0.31 (0.13–0.71)**	0.55 (0.14–2.26)
Architecture and engineering	**0.23 (0.08–0.68)**	0.78 (0.18–3.32)	0.36 (0.08–1.51)	2.02 (0.47–8.61)
Life, physical, and social science	**0.36 (0.21–0.61)**	1.07 (0.51–2.25)	**0.35 (0.15–0.82)**	0.63 (0.15–2.58)
Community and social services	**0.54 (0.36–0.81)**	**0.25 (0.08–0.77)**	0.62 (0.36–1.07)	0.41 (0.01–1.66)
Legal	**0.48 (0.28–0.83)**	0.76 (0.30–1.90)	0.58 (0.28–1.23)	0.74 (0.18–3.06)
Education, training, and library	**0.51 (0.42–0.63)**	**0.45 (0.30–0.69)**	**0.22 (0.15–0.33)**	**0.41 (0.21–0.81)**
Arts, design, entertainment, sports, and media	**0.60 (0.37–0.96)**	1.11 (0.55–2.23)	0.83 (0.47–1.48)	0.57 (0.14–2.32)
Healthcare practitioners and technical	**0.48 (0.39–0.60)**	**0.49 (0.32–0.75)**	**0.55 (0.41–0.74)**	1.01 (0.62–1.65)
Group two				
Healthcare support	1.29 (0.99–1.67)	1.01 (0.65–1.57)	**1.53 (1.14–2.05)**	0.48 (0.20–1.17)
Protective service	1.01 (0.54–1.88)	**2.26 (1.04–4.94)**	1.37 (0.67–2.82)	1.22 (0.29–5.08)
Food preparation and serving-related	**2.34 (1.89–2.90)**	**1.82 (1.36–2.44)**	**2.98 (2.40–3.70)**	**2.72 (1.88–3.93)**
Building and grounds cleaning and maintenance	**3.08 (2.12–4.49)**	**2.69 (1.75–4.13)**	1.30 (0.87–1.94)	**2.35 (1.28–4.31)**
Personal care and service	1.01 (0.79–1.30)	1.09 (0.72–1.64)	0.99 (0.72–1.36)	1.14 (0.63–2.07)
Sales and related	**1.59 (1.34–1.89)**	1.29 (0.98–1.68)	**1.63 (1.34–1.98)**	0.98 (0.64–1.52)
Office and administrative support	1.14 (1.00–1.30)	0.90 (0.72–1.13)	1.13 (0.96–1.33)	0.96 (0.70–1.35)
Farming, fishing, and forestry	**4.62 (2.50–8.55)**	**2.06 (1.03–4.12)**	**0.36 (0.15–0.91)**	0.38 (0.05–2.77)
Production	**2.60 (1.94–3.47)**	**2.17 (1.50–3.12)**	**1.47 (1.07–2.01)**	0.66 (0.29–1.51)
Transportation and material moving	**2.34 (1.57–3.48)**	**2.08 (1.27–3.41)**	1.43 (0.93–2.22)	0.65 (0.20–2.06)

Figures in bold indicate significance at $p<0.05$.

[a] One month before pregnancy through the third month of pregnancy.

[b] During B1–P1 (one month before pregnancy through the first month of pregnancy).

[c] >1 drink per day average in any month.

[d] Service; sales and office; natural resources, construction, and maintenance; and production, transportation, and material moving occupations.

[e] The referent group for all major occupational group comparisons was all other major occupational groups.